

1.2.2 Periodic data and structure

Name: _____ Class: _____ Date: _____

Total: 26 marks

KEY WORDS ionisation energy • orbital

Objective

Use configurations, graph axes and structure models to interpret periodic data through krypton. Original supplied data and marking guidance; this is not an official paper.

1 Key knowledge and worked examples

■ Read the subshell and the axis

The s, p and d blocks identify the subshell receiving the differentiating electron. K ends in $4s^1$ and is s-block; Sc ends in $3d^14s^2$ and is d-block; As ends in $4p^3$ and is p-block. Helium is s-block by its $1s^2$ configuration although it is placed with the noble gases.

On a linear energy axis, a rise of 100 kJ mol^{-1} has the same vertical distance everywhere. On a $\log_{10}$ axis, equal distances represent equal energy ratios: changing from 3.0 to 3.3 corresponds to a factor of about 2. Use $\log_{10}(E / \text{kJ mol}^{-1})$ so the logarithm refers to the numerical energy in the specified unit. A logarithmic plot preserves the order of values.

Do not explain every periodic property with nuclear charge alone. Melting depends on the particles, bonding and structure; removing one gaseous electron is a different process from melting a solid.

2 Practice

2.1 Classify K, Sc, As and He into s, p or d blocks using the configurations above. Explain why helium's noble-gas column does not make it a p-block element. [4]

3 Exam-style questions

3.1 Use your graphs to identify three decreases that mark the start of a new occupied outer shell. Explain the general decrease using distance, shielding and nuclear charge. State one advantage of the logarithmic representation. [4]

3.2 Explain why the first-ionisation energy falls from Be to B and from N to O, although nuclear charge increases in each case. Give the relevant outer configurations. [4]

3.3 Classify Li/Be, B/C, N₂/O₂/F₂ and Ne by their Period-2 solid structures. Explain why carbon has a much higher melting temperature than nitrogen, and why melting nitrogen does not break its N≡N bonds. [5]

3.4 A student describes the first 36 elements as a smooth rise interrupted only after noble gases. Evaluate this claim using two counterexamples from the table. Explain why this graph alone cannot predict every element's melting temperature. [3]
